# OBSERVATIONS ON THE DIET AND SIZE VARIATION OF AMPHIBOLURUS ADELAIDENSIS (GRAY) (REPTILIA: AGAMIDAE) ON THE NULLARBOR PLAIN

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## SUMMARY

Forty-one specimens of *A. adelaidensis* (Gray) were captured and the stomach contents examined. Measurements of the body length of the lizards were recorded, and the variation suggests that the life span in the natural environment does probably not exceed two or three years. A general description of the specimens captured was made, and the taxonomic problems associated with the original description are discussed. From analyses of the stomach contents, it is concluded that *A. adelaidensis* is probably a discriminate feeder.

## INTRODUCTION

The food items selected by large reptiles may be determined by direct observation upon the animals in their natural habitat, or examination of faecal matter (Leydig, 1896). For smaller species, where it is impossible to identify at a distance the food items ingested, different methods are employed.

Acceptance or refusal of food items offered to a captive specimen may provide interesting data, but the obvious limitations, due to the reduced variety of available prey, imposed upon the animal, could result in the acceptance in captivity of prey normally rejected in the natural environment.

By far the most satisfactory method, which has been employed for both the Reptilia and Anura, is the examination of the stomach contents of a series of specimens captured at random in the field.

Food items selected or rejected by Australian lizards have been mentioned by several writers, the earliest probably being an observation by Krefft (1871), who noticed that *Tiliqua* (*Cyclodus*) sp., "feeds, besides insects, upon the berry called 'jee-bung', and also on other berries and leaves".

More recently Coleman (1945) reported that *Tiliqua* (*Trachysaurus*) *rugosa* (Gray) and *Amphibolurus barbatus* (Cuvier) in captivity ate soft fruits, dandelions and other flowers, snails, eggs (previously broken), milk, bananas and raw beef; similar observations upon the former species having been previously mentioned in a publication by Longley (1940). The latter author also records *Gymnodactylus spyrurus* (Ogilby) accepting caterpillars, isopods, the native cockroach *Panesthia laevicollis* and an introduced species quoted to be *Blatta americana* (presumably a confusion between *Blatta orientalis* and *Periplaneta americana*), but rejecting the vine moth *Agarista glycinea*. *G. platurus* is stated to eat similar food items, and was also found to reject both the larvae and adults of *A. glycinea*.

A very interesting observation by Davey (1944), revealed that *Moloch horridus* (Gray) rejected certain species of ants but accepted others. Those rejected were stated to be *Iridomyrmex detectus*, *I. nitidus*, *Ectatomma metallicum*, *Monoromorium*, *Camponotus* and *Pheidole* spp., whilst *Iridomyrmex*

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*rufoniger* was accepted at a daily consumption rate estimated by the writer at 1,350 specimens.

Neither previous papers mentioning stomach analyses of Australian specimens captured in the field, nor any record of food items ingested by *Amphibolurus adelaidensis* (Gray) (The Queen Adelaide Dragon) have been traced by the writer of this paper.

For reasons discussed later, the distribution is a matter of some conjecture. It has apparently been recorded in Western and South Australia, Victoria and Tasmania (Zietz, 1920; Lord & Scott, 1924; Waite, 1929).

Large numbers were observed by the writer upon the Nullarbor Plain at the Commonwealth Railways fettlers' camp "639 miles" W.N.W. of Port Pirie during the period 6th-15th February, 1959. In this region *A. adelaidensis* was the predominant species, being associated with *Gymnodactylus milii* (Bory de Vinc.), and *Tiliqua rugosa* (Gray).

## METHODS

*A. adelaidensis* lives either singly or gregariously in short burrows beneath large rocks or flat stones from which they emerge in search of food. If disturbed whilst upon the surface of the ground, the lizards return to the burrow with considerable speed. It was observed in the course of collecting that if the rock covering the burrow was then removed, the lizard did not rely upon escape by fleeing from the intruder, but searched haphazardly for a new retreat within the immediate vicinity, frequently selecting the instep of the writer's shoes. Young specimens, however, remained in the exposed burrow, relying for protection upon their excellent camouflage which closely resembled the sandy soil. Forty-one specimens were subsequently captured at random by hand with very little difficulty.

Shortly after capture the specimens were killed with the fumes of ammonia or carbon tetrachloride or by pithing. Measurements of the body, dorsally, from the external nares to the apex of the tail and, ventrally, from the anterior tip of the upper jaw to the vent were recorded.

The body viscera were examined for the presence of anatomical abnormalities and parasites, whilst the stomach contents were removed and the food items, where insects, identified to the order and if possible to the family.

## OBSERVATIONS

### (a) *Size variation*

The sizes of the specimens illustrated in the form of a histogram in Figure 1 are ventral measurements of the body from the anterior extremity to the vent, and not the total length of body plus tail, because it was observed that the tails of several of the mature specimens had been previously severed and were in various stages of regeneration.

The largest total lengths recorded were: 135 mm., 142 mm., 154 mm. males; 159 mm., 160 mm., 172 mm. females.

The distribution of the sizes in the histogram falls into two clearly defined, apparently homogeneous groups which have been lettered A and B. The specimens in A are all juveniles which will have hatched from eggs laid by group B in the previous season. A is therefore homogeneous in sexual immaturity since all its members are incapable of reproduction. Post mortem examination of the gonads of group B revealed what was believed to be sexual maturity in all specimens and homogeneity similarly applies.

The presence of a distinct gap between the groups (only one specimen being recorded between 36-45 mm.) represents the growth made by the next preceding generation during the winter months before the appearance of the generation seen in A, a time when no lizards are born.

Similar observations were made by Simpson and Roe (1939), who examined data compiled by Blanchard and Blanchard (1931) upon the salamander *Hemidactylium scutatum*, and by the writer (1958) upon the frog *Rana esculenta*.

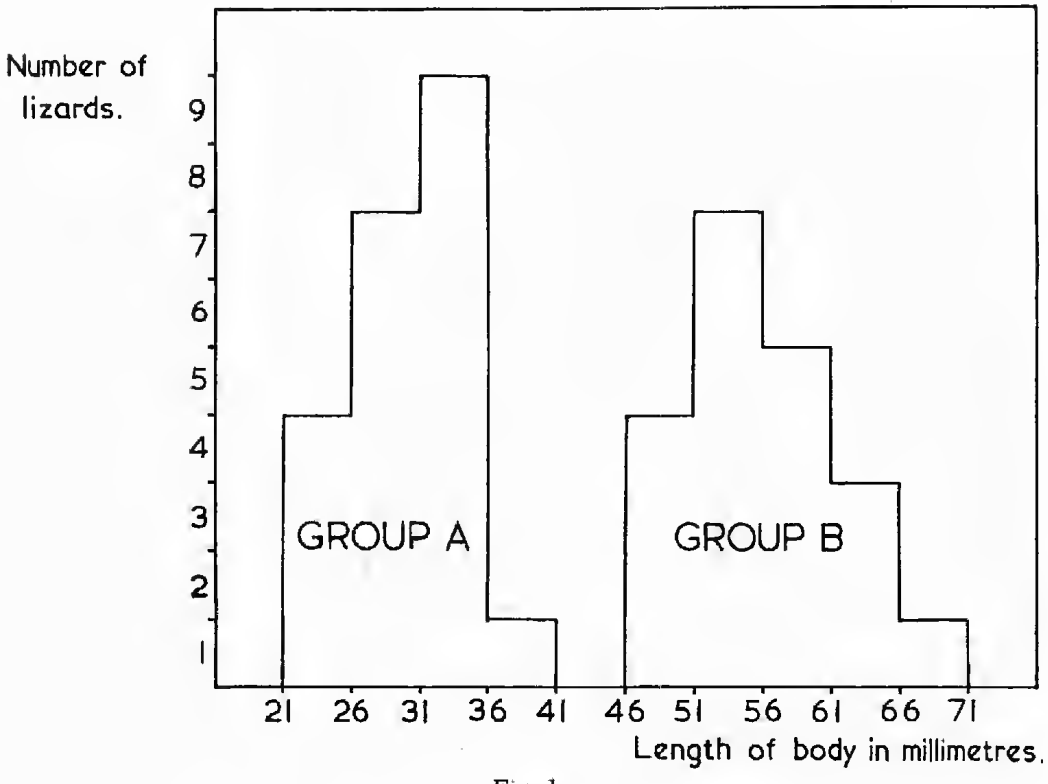


Fig. 1

The rapid initial rate of growth by *A. adelaidensis*, the increase in size during the first year, and the presence of only a single peak in B would suggest that the life span in the natural environment does not exceed two or three years, although it was previously believed that this species lived for much longer.

(b) *Food items recovered*

No apparent difference in the food items recovered from juvenile and adult lizards was recorded, and so the entire prey have been treated as a whole in the histogram (Fig. 2).

The Coleoptera consisted of single specimens of the families Staphylinidae and Tenebrionidae, whilst the Hemiptera was represented by four specimens of the family Pentatomidae and one other unidentified specimen.

Three of the Lepidoptera were adult moths, the remainder being larvae varying in size from a specimen measuring 14 mm. in length to first or second instars of approximately 1 mm. length.

The Orthoptera were all small grasshoppers (family Acrididae).

With the exception of one small parasite (family Ichneumonidae) the Hymenoptera recovered consisted of various species of ants (family Formicidae).

The remainder consisted of one fly (Diptera, family undet.) and five spiders (Arachnida, family Araneae).

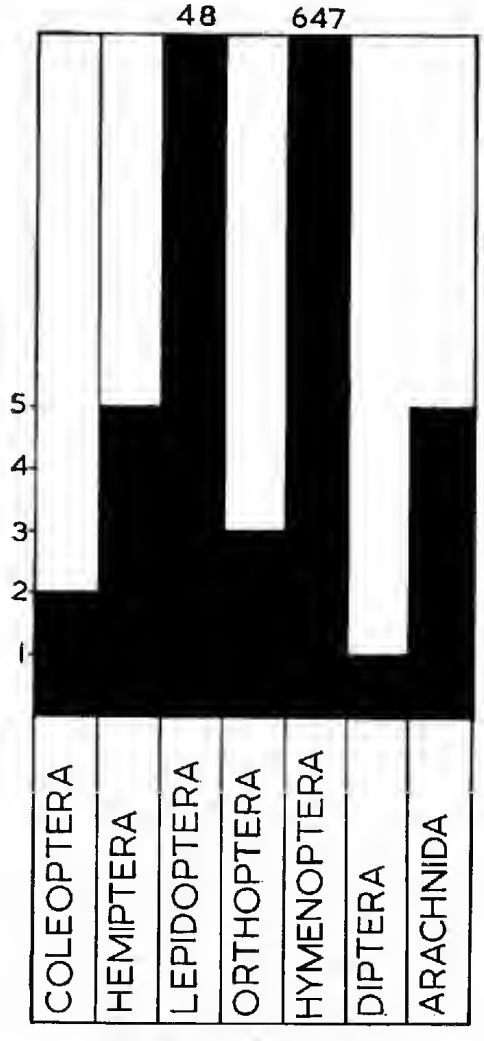


Fig. 2. Number of prey.

## DISCUSSION

(a) *Taxonomic problems arising from the original description*

The specimens upon which this paper is based are typical of the form regarded as *Amphibolurus adelaidensis* by Boulenger, 1887, and Waite, 1929.

The original description by Gray (1841) of specimens collected by Gould in the locality of the Swan River is very scant by modern standards, and is based mainly on colour pattern which, as described below, is variable. He named the specimens *Grammatophora muricata* var. *adelaidensis*.

The following description of the specimens examined by the writer on the Nullarbor Plain incorporates and elaborates those of Waite and Gray.

The adpressed hind limbs extend to or almost to the tympanum.

The scales are strongly keeled and are largest on the dorsal surface, where they appear in distinct posteriorly projecting rows on either side of the mid-line, extending from the cranium to the base of the tail. On each lateral aspect of the base of the tail is a series of outwardly projecting spines extending posteriorly for a distance in mature specimens of approximately ten millimetres, and are similar to those previously mentioned in that they also possess three spines.

The pores are either regularly situated or interrupted in the preanal region, and extend little more than half way down the thighs. The total number of pores varies between twenty and thirty, more commonly nearer the lower figure.

The ground colour on the dorsal and lateral surfaces of the body varies from grey to olive-grey. There is a series of paired, small brown, angular markings on the back which are adjacent superiorly to larger, similarly coloured, but less clearly defined markings on the dorso-lateral surface between the limbs.

The head is of a reddish-brown colouration with symmetrical dark brown markings; dark brown bars on the hind limbs are narrower and less conspicuous on the fore limbs.

The tail with a series of paired, dark brown markings of rectangular form at the base which become irregular posteriorly, and merge into symmetrical bands towards the extremity.

The ventral surface a pale cream colouration with a broad black stripe extending from the abdominal ventro-lateral surfaces, which fuses on the mid-ventral line in the region of the thorax. Black markings on the throat extremely variable, being present as an irregularly shaped patch, spotted producing a marbled appearance or completely absent.

A rapid colour change was observed in specimens placed from dark on to light surfaces and vice versa. On the dark surface the brown dorsal markings greatly increased in intensity. When placed on a white surface, the brown markings became paler, and approached a reddish-orange tint and a pattern of markings appeared that had not been observed in the field.

Three very distinct longitudinal, pale grey stripes appeared on the dorsal surface, one extending as a vertebral stripe, between the angular markings, from the base of the skull posteriorly to the base of the tail, where it was replaced by a series of pale brown bars also not previously visible. From a site posterior and superior to the typanae appeared two similarly coloured but slightly narrower stripes which diverged slightly in the middle of the back, and then passed beyond the termination of the vertebral stripe, and parallel to it, to a point situated approximately one third of the way down the tail where they merged with the ground colouration.

Since the colour of *A. adelaidensis* varies so much from one individual to another, the extremes of the range may be retained after preservation of specimens for museum collections, and thus be a contributory cause to the present confusion of the status of the species.

Stirling and Zietz (1893) found the measurements of the larger of two specimens collected between Queen Victoria Spring and Fraser Range to be: body 50 mm.; tail 70 mm. = total length 120 mm. Waite (1929) recorded a specimen measuring: body 48 mm.; tail 78 mm. = total length 126 mm. Since the Nullarbor material included several specimens exceeding these in length, it is suggested that the former had not reached maximum size when captured.

A form distributed in S.W. Australia and observed by the writer on the

Nullarbor Plain a few miles east of Deakin, lacks the lateral spines at the base of the tail.

There exists a very real need for a revision of all species at present with the genus *Amphibolurus*, for only after such a measure can the distribution of *A. adelaidensis* be correctly determined.

(b) *Factors limiting the variety of potential prey*

Before discussing the diet of *A. adelaidensis*, it is advisable to consider the environmental factors, especially seasonal and climatic conditions, which determine the variety and population density of those insects which can, by virtue of their size, be regarded as potential prey.

The region where the lizards were captured is one of the most barren parts of the Nullarbor Plain. Live vegetation consisted of occasional xerophytic plants which, because of their high salt concentration, are unsuitable host plants to any but a few species of specialised insects.

The presence of occasional dense swarms of flies, however, provided a reminder that the region is not entirely lacking in organic matter.

The temperature at the time of most of the captures was 90°-110° F., whilst Northerly winds were maintained, which is of interest since it has been established that wind inhibits the flight of insects, particularly flies.

It may be presumed that the conditions on the Nullarbor Plain are most suitable, so far as lepidopterous insects are concerned, for those species capable of completing their metamorphosis in the short period after the rainy season when the vegetation is most prolific, and then adapt themselves to arid conditions.

A seasonal variation in the insect population will be reflected by stomach contents of insectivorous lizards, if they are indiscriminate in their feeding habits.

(c) *The feeding mechanism*

Knowledge of the powers of sight and the stimuli inducing ingestion in the Sauria and Batrachia is improperly known, and certainly varies between different species.

If the feeding mechanism is an automatic one induced solely by the movement of a small object within the animal's range of vision, then the creature must be an indiscriminate feeder.

Such a case is well illustrated by the example of large frogs of the family Ranidae, which were observed by the writer to inhabit a reservoir at Maltepe, near Istanbul, Turkey, which automatically ingested any small object thrown near to them, including stones.

The other extreme is where animals are capable of distinguishing between closely allied insect species, as is the case with *Moloch horridus* discussed earlier. In this instance sight probably played very little part in the discrimination, for the species selected was characterised by a strong smell (obnoxious to the human being), which was absent in the species rejected.

As has been seen in Fig. 2, the Hymenoptera was the order of insect most frequently ingested by *A. adelaidensis*, and it is most difficult to decide whether the species discriminated between different types of prey, or whether availability is the all important factor. Ants were undoubtedly the insects most frequently seen, and would presumably form a high proportion of the total insect population were an ecological survey undertaken.

A consideration of many papers on various animals led McAtee (1932) to conclude that availability is the all important factor governing the food items

ingested. This can hardly be considered a complete answer in itself, for species of similar size and habits in the same region (Cott, 1957) show marked differences in the prey selected. Another point previously almost completely ignored is that individuals within a species captured under identical conditions differ widely in prey selected and demonstrated, even in the Batrachia, apparent individualistic tendencies (Tyler, 1958).

The present paper records the diet of *A. adelaidensis*, which foraging for food is probably a discriminate feeder, but its limitations reveals the need for new field techniques for dietary studies upon small animals.

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